S.403.A.

Yorkshire Philosophical Society.

ANNUAL REPORT

FOR

MDCCCLXXXII.

ANNUAL REPORT

OF THE COUNCIL

OF THE

YORKSHIRE

PHILOSOPHICAL SOCIETY

FOR

MDCCCLXXXII.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 6TH, 1883.

BRITISH MUSEUM NATURAL HISTORY

YORK:
J. SOTHERAN, BOOKSELLER, CONEY STREET.

1883.

TRUSTEE

OF

THE YORKSHIRE MUSEUM,

APPOINTED BY ROYAL GRANT.

COLONEL EDWARD W. HARCOURT.

PATRONESSES

OF THE

Yorkshire Philosophical Society.

HER MAJESTY THE QUEEN.

H. R. H. THE PRINCESS OF WALES.

PATRONS.

H. R. H. THE PRINCE OF WALES, K.G.

H. R. H. THE DUKE OF CONNAUGHT, K.G.

HIS GRACE THE ARCHBISHOP OF YORK, F.R.S.

OFFICERS OF THE SOCIETY, 1883.

PRESIDENT:

His Grace the Archbishop of York, F.R.S., &c.

VICE-PRESIDENTS:

The Right Hon. Lord Londesborough.
The Hon. Payan Dawnay.
The Very Reverend the Dean of York.
William Henry Rudston Read, M.A., F.L.S.
Egerton Vernon Harcourt, M.A., F.G.S.
The Rev. Canon Raine, M.A., D.C.L.
William Reed, F.G.S.
John Francis Walker, M.A., F.L.S., F.G.S., F.C.S., &c.
William Walker, F.G.S.
S. W. North, F.G.S.

HON. TREASURER:

Edwin Gray, LL.M.

COUNCIL:

Elected 1881. .George Oldfield.
Mr. Alderman Terry.
Elected 1882. .Richard Thompson.
F. L. Mawdesley.
Rev. W. C. Hey, M A.
Robert Baker, M.D.
Elected 1883. .The Rev. M. R. Bresher, M.A.
The Rev. T. B. B. Ferris, M.A.
Tempest Anderson, M.D.
Thomas Gough, B.Sc.
Elected for one year { John Teasdale, M.A.
William Atkinson.

HON. SECRETARY:

T. S. Noble, F.G.S.

CURATORS:

Geology	W. Reed, F.G.S.
Mineralogy	W. H. Hudleston, M.A., F.G.S.
Insects and Crustacea . .	Rev. W. C. Hey, M.A.
Comparative Anatomy . .	T. Anderson, M.D.
British Ornithology . .	W. H. Rudston Read, M.A., F.L.S.
Antiquarian Department .	Rev. W. Greenwell, D.C.L., F.R.S. Rev. Canon Raine, D.C.L.
Library	
Botany	William Matterson, M.D.
Conchology	Rev. W. C. Hey, M.A.
Observatory & Meteorology	T. S. Noble, F.G. S.

KEEPER OF THE MUSEUM.

Walter Keeping, M.A., F.G.S.

REPORT OF THE COUNCIL

OF THE

YORKSHIRE PHILOSOPHICAL SOCIETY,

FEBRUARY 6TH, 1883.

In presenting the Report for the year 1882, the Council congratulate the Members of the Yorkshire Philosophical Society on the prosperity of the Society during the past year, both in its financial and scientific affairs. The Report will briefly disclose the present condition of the various departments of the Museum, and the balance sheet of the Treasurer will show that financially the year has been one of equal prosperity. During the last seven years the Council, from various causes which have been explained from time to time in their annual Reports, chiefly arising from the expenses incident to the augmentations which have been made to the various collections in the Society's rooms, have had to report a gradually increasing deficit at the close of each year. The debt due to the Treasurer, apart from the permanent debt, amounted at the close of last year to £1,642 15s. 4d., and last year there was an excess of expenditure over income of upwards of £250. Although the income of the Society during the present year is small compared with those on previous occasions, the Treasurer has much pleasure in reporting that the excess of income over expenditure on the past year's balance sheet amounts to £59. 0s. 7d. This pleasing feature in the Society's finances fully justifies the statements made by the Council on previous occasions that the debt will be gradually extinguished. This part of the subject will be further dealt with on the presentation of the Treasurer's balance sheet. Reference will now be made to the present condition of the various departments in the Museum.

Geology.—The additions to the Geological Department during the year include gifts from the following gentlemen:—Rev. Canon Raine, M.A.; Rev. E. A. Healy, M.A.; Rev. J. Taylor, M.A.; Mr. William Reed, F.G.S.; Professor O. C. Marsh; Professor A. S. Herschel; W. H. Hudleston, Esq., M.A.; C. D. Wolstenholme, Esq.; J. S. W. Kirkpatrick, Esq.; A. J. Barry, Esq.; S. Chadwick, Esq.; G. Edson, Esq.; J. E. Jones, Esq.; F. Wright, Esq.; — Jackson, Esq., and C. S. Middlemiss, Esq.

Some of the most important of these gifts are fossils from the Yorkshire rocks, such as the choice specimens of *Sponges, Mollusca, Echinodermata, etc.*, from the Yorkshire Chalk, presented by Mr. S. Chadwick, of Malton; and the series of Ironstone fossils from Grosmont, presented by Mr. Wm. Reed.

Also the collection of Yorkshire fossils has been further increased by numerous specimens, collected by the Keeper of the Museum, many of them from localities hitherto unrepresented in the Museum. These are species from the Lower Jurassic Sands and Dogger of the Peak near Whitby, and from Glaisdale, the Scarborough Limestone of Gilling near Coxwold, and Stonecliffe Wood near Castle Howard, and from the Lower and Middle Oolites, especially the Kelloway Rock, of the new Railway Cuttings (Hull and Barnsley line), near South Cave.

A collection of Yorkshire Rocks is also in course of formation and many specimens have been obtained. In this way it is hoped that the inland Geology of Yorkshire will become more fully illustrated in the Museum, thus supplying a conspicuous want in the County collection.

From Norway a series of rocks principally metamorphic has been collected, and some examples of the newly discovered fossil remains from the metamorphic schists of Vagtdalen, South of Bergen, have been obtained.

The arrangement of the specimens has been continued as before, the Coal Measures, Devonian, Carboniferous Limestone, Old Red Sandstone, Silurian, and Cambrian series, being placed in the drawers of the central case in the Tertiary Room.

The drawers have been provided with card-board covers to protect them from the dust.

The Upper and Middle Oolites of Yorkshire have been re-arranged in the Saurian Room, also the Yorkshire Chalk, the recent gifts being added.

Mr. H. Keeping, of the Cambridge Museum, has kindly devoted a fortnight to a careful revision of our collection of Oligocene and Eocene fossils, arranging the species in their proper zones.

The Curator of ANTIQUITIES reports a large accession to the curiosities under his charge, so large, indeed, that in no preceding year have so many objects of interest found their way into this Department of the Museum.

No Roman inscription indeed has been found during the year, and no sculptured stone of any importance; but, to represent the period of the Imperial occupation of Britain, we have fifteen urns acquired during the year; and two tombs of tiles discovered on Bishophill, in one of which was a bracelet made of gold and silver wires. To the collection of old English pottery and glass more than fifty additions have been made, and in every part of the Antiquarian stores fresh objects of interest may be seen, which will be enumerated either in the Catalogue of Antiquities, or in the Report for the year.

Special allusion must be made to three conspicuous additions to our treasures.

1. A large number of silver pennies of Edward the Confessor and William the Conqueror, discovered in York last summer. The pennies of Edward, which are very numerous, are remarkable for being productions of the York Mint, and in variety and excellence of workmanship bear abundant testimony to the importance of York at that early period. The coins, speaking generally, belong to the last five or six types of the Confessor's coinage and the two earliest of William the Conqueror, and furnish some most curious additions to the numismatic history of those two reigns.

2. In July last the Society received as a gift from Mr. Edward Hailstone, of Walton Hall, near Wakefield, an old friend and benefactor, a large collection of antiquities. They comprise some fifty stone and bronze implements of the pre-

historic era, numerous specimens of Roman, Etruscan, and English pottery; some forty matrices of foreign seals prior to the sixteenth century; many original impressions of Royal seals of England; and a very large quantity of casts and impressions of the same kind.

The choicest part of Mr. Hailstone's gift is a noble pair of Roman bowls of bronze, found at Finningley, near Doncaster, which would be an ornament to Museums far more important than ours.

3. The last and most conspicuous place in the list of accessions must be occupied by the collection of antiquities made by the late Mr. George Alderson Robinson, of Reeth, which has been most generously presented to us by his representatives. The kernel of this collection is a very large assemblage of pre-historic antiquities from Ireland, which was purchased at Edinburgh in 1877. Among them are two large bronze cauldrons of bronze, and a very fine trumpet of the same material. The implements in flint and stone are exceedingly numerous. Mr. Robinson also acquired by purchase the antiquities gathered together by the late Mr. Edward Wood, of Richmond, whose geological treasures we already possess through the kindness of our esteemed V.P., Mr. Wm. Reed. He bought also many pre-historic remains from Denmark, America, and other countries, all of which have come to us. Around these there is a wide fringe of miscellaneous objects, illustrative, many of them, of the industries pursued in the Richmondshire Dales. We have acquired also from the same generous donors numerous specimens of weapons and armour, in which the Museum was singularly deficient. It must also be mentioned that the curiosities are accompanied by the cases which contained them, and by this thoughtful kindness the resources of the Museum will not be materially taxed to provide additional accommodation. The Society has every reason to congratulate itself on the very great and valuable additions which have been made to the Department of Antiquities during the past year.

The Curator of British Ornithology has to report the capture of one very rare visitant to our shores. The American

Bittern (*Ardea lentiginosa*, Yarrell and Gould, *Botaurus mokoho*, Selby), shot by the Honorable W. Dawnay, Harlsey Hall, near Northallerton, on October 27th, 1882. He had not heard of this bird since 1804, when one was shot near Frome, now preserved in the British Museum.

Common Buzzard shot at Allerton, May 26, 1882; Spotted Crake, September 20, Askham; Little Auk, October 27, Harrogate; Peregrine Falcon, November 24, Escrick; White Fronted Wild Goose, East Cottingwith, October 27; Waxwing, shot at Acaster, December 19, 1882; Common Bittern, near Hull, December 22.

He has to thank Mr. Edward Allen, Bird Preserver, Feasegate, for the information he has kindly received from him.

CONCHOLOGY.—The principal work in this department has been the arrangement of a series of fresh-water Mussels from the Rivers of North America. They were presented some years ago by Mr. Clarke, of Cincinnati, and form an interesting and beautiful collection.

ENTOMOLOGY.—At the desire of the late Curator, the Rev. W. C. Hey has devoted some time and attention to the re-arrangement of the foreign Coleoptera. This work is at present in hand.

The Curator of the Department of MINERALOGY has nothing to report. There has been no change in the arrangement of the remainder of the collection. The Curator hopes to do this, and also to add some necessary specimens in the course of the present year.

BOTANICAL Curator's Report.—The various British Herbaria have been examined and found in a good state of preservation. W. H. R. Read, Esq., has kindly presented to the Society 30 valuable Plants, consisting of Palms of different varieties, some ornamental Foliage Plants and hardy herbaceous ones.

In the Comparative Anatomy Department the additions have been of a minor character, but the collection which was recently re-arranged is in good order.

METEOROLOGY.

The Meteorological Records for 1882 shew little that is unusual and exceptional.

The Mean Shade Temperature was high, namely, 48·8°, which is above the Means of the preceding 14 years; but the extreme readings were never excessive, the highest being 75·3 on August 6th, and the lowest 16° on December 12th, giving a range of 59·3 degrees.

The mean height of the Mercurial Column amounts to 29·885 inches, which is slightly above the average. An unusually high reading (30·894) was observed on Jan. 18th, which has not been equalled since 1854. The Barometer remained high during most of the month, and February is also noticeable for its high pressure, the mean height being 30·146. The range of pressure during the year was from 28·804 on March 1st, to 30·894 on January 18th, shewing a fluctuation of 2·09 inches.

The Rainfall of the year has been excessive, the quantity measured being 33·15 inches, which fell during 212 days. The average Rainfall is about 24 inches, but in 1877 it reached 33·27. The early months, January, February, and March, were distinguished by their dryness, also May and September, the Rainfall being less than two inches in each of them; but in April, October, and December the Rainfall was high, exceeding four inches. The heaviest rain occurred on December 6th, when it amounted to 1·45 inches.

Mr. Henry Richardson has sent us his Records of the Rainfall at Cherry Hill, York, (total, 32·94), and at Ilkley, (total, 48·12). The latter place is 640 feet above sea level, and its average Rainfall is 36·38 inches.

The Record of the Winds of 1882 shews nothing very unusual. There was less North wind (50 observations) than last year, while the South (149 obs.) and West (137) winds have predominated.

Auroral lights were observed in York on the 12th, 13th, 14th, 15th, 17th, 18th, and 19th of November, that of the 17th being of great splendour.

The River Ouse has not been frozen over during the year. On two occasions in December the water rose 10 feet or more above summer level.

METEOROLOGICAL REGISTER, YORK, 1882.

Based on observations taken at the Museum at York at 9 a.m. and 9 p.m. each day, local time. The self-registering thermometers were read at 9 p.m., and the readings entered to the day on which they were made, while the Rainfall was measured at 9 a.m., and the amount registered entered to the *preceding* day.

	BAROMETER.			RAIN.		THERMOMETER.				
Month.	Highest.	Lowest.	Mean.	Inches.	Days.	Average Maximum.	Average Minimum.	Mean Temp.	Highest.	Lowest.
	Inches.	Inches.	Inches.			Deg.	Deg.	Deg.	Deg.	Deg.
Jan.	30·894	29·038	30·277	1·49	13	45·7	35·8	40·8	53·0	28·0
Feb.	30·726	28·873	30·146	1·27	8	48·0	37·5	42·8	55·0	27·0
Mar.	30·567	28·804	29·906	1·79	14	53·2	37·9	45·6	64·2	29·0
April	30·520	28·931	29·774	4·15	17	53·6	39·0	46·3	64·8	29·6
May	30·509	29·299	30·058	1·49	12	62·0	42·1	52·1	70·5	32·5
June	30·403	29·306	29·853	3·25	17	64·4	47·8	56·1	73·4	38·7
July	30·433	29·158	29·797	3·74	23	67·5	51·9	59·7	74·0	44·0
Aug.	30·304	28·999	29·856	2·35	20	67·5	51·2	59·4	75·3	44·0
Sept.	30·461	29·266	29·861	1·20	16	62·2	45·5	53·9	68·5	37·6
Oct.	30·616	29·133	29·845	4·84	25	55·5	45·4	50·5	68·4	33·2
Nov.	30·212	28·997	29·612	2·71	24	46·4	36·5	41·5	59·8	24·0
Dec.	30·249	28·919	29·635	4·87	23	40·5	33·6	37·1	55·0	16·0
Year	30·894	28·804	29·885	33·15	212	55·5	42·0	48·8	75·3	16·0

Note.—The Barometer readings have been corrected and reduced to 32° F. at the Mean Sea Level.

RAINFALL AT YORK, 1882.

Month.	Total Depth.	Greatest Fall in 24 Hours.		Days on which ·01 or more fell.	At Cherry Hill, York.	At Ilkley.
	Inches.	Depth.	Date.		Inches.	Inches.
Jan.	1·49	·57	29	13	1·49	3·81
Feb.	1·27	·67	26	8	1·24	2·60
Mar.	1·79	·45	25	14	1·85	4·7½
April	4·15	·95	13	17	4·01	5·66
May	1·49	·43	26	12	1·32	1·47½
June	3·25	·78	22	17	3·44	5·6
July	3·74	·47	27	23	3·73	4·1
Aug.	2·35	·34	29	20	2·34	2·54½
Sept.	1·20	·20	1 & 12	16	1·24	2·66
Oct.	4·84	·75	24	25	4·95	5·10
Nov.	2·71	·31	8	24	2·65	6·95
Dec.	4·87	1·45	6	23	4·68	4·17½
Year	33·15	1·45	Dec. 6	212	32·94	48·12

HEIGHT OF RIVER OUSE, 1882.

January..	Various heights from 4in. above Summer level to 9ft. 3in. (4th).
February	From S. L. to 6ft. (27th).
March	From S. L. (10 days), to 9ft. (2nd).
April	From S. L. (8 days), to 8ft. 10in. (15th).
May	Principally S. L., highest, 7ft. 6in. (1st).
June	Principally S. L. to 24th, highest, 4ft. 6in. water off 25th to 1st July.
July	S. L. 9 days, remainder various, highest, 3ft. 9in.
August	Principally S. L., highest, 1ft. 4in.
September	Principally S. L., highest, 1ft. 4in.
October	To 14th various, highest, 3ft. 2in., water off 15th to 19th, remainder various, highest, 6ft. 4in. (25th).
November	Various, highest, 9ft. 7in. (6th).
December	From 3in. (16th) to 10ft. 10in. (30th).

HEIGHTS IN DECEMBER.

	feet.	inches.
18th	9	3
19th	10	0
20th	9	2
21st	9	0
22nd	9	10
23rd	8	2
28th	9	10
29th	9	4
30th	10	10
31st	5	0

STATION, YORK, 1882.

WIND SUMMARY.—NUMBER OF OBSERVATIONS UNDER EACH POINT.

MONTHS.	NORTH	N.N.E.	N.E.	E.N.E.	EAST	E.S.E.	S.E.	S.S.E.	SOUTH	S.S.W.	S.W.	W.S.W.	WEST	W.N.W.	N.W.	N.N.W.	Calm.	Variable.
January	0	0	0	0	3	1	1	4	19	8	2	4	17	0	1	0	2	
February ..	2	0	0	1	2	0	1	3	17	4	5	1	13	3	3	0	1	
March	2	0	0	0	1	0	0	1	10	3	7	8	20	4	3	3	0	
April	5	4	2	5	9	3	3	3	8	3	1	4	5	1	1	3	0	
May	5	3	3	4	8	1	4	3	13	1	0	1	8	0	3	4	1	
June	3	1	0	1	5	1	0	1	12	1	5	8	5	5	5	7	0	
July	2	0	1	1	0	0	0	2	17	6	15	4	10	2	0	2	0	
August	1	0	0	0	2	2	1	3	9	3	3	2	20	9	6	0	1	
September ..	5	1	3	4	2	2	0	4	12	2	4	1	10	2	5	2	1	
October	2	1	6	3	11	1	4	5	15	0	1	1	7	2	1	1	1	
November ..	8	0	2	2	2	0	1	4	7	5	3	6	13	3	0	4	0	
December ..	15	3	3	1	3	3	2	2	10	2	1	1	9	1	1	5	0	
Sums ..	50	13	20	22	48	14	17	35	149	38	47	41	137	32	29	31	7	

The following Evening Lectures have been delivered in the Theatre of the Museum :—

February 21st	On "The Atlantic Ocean," by The Rev. G. Rowe, M.A.
March 7th	On "The Upper Cambrian Rocks," by W. Keeping, M.A., F.G.S.
,, 21st	On "The Life History of a Raindrop," by A. S. Read, B.A., F.G.S.
April 4th	On "The Upper Cambrian Rocks and their Fossils," by W. Keeping, M.A.
,, 18th	On "Lakes and their Natural History," by Professor P. M. Duncan, F.R.S.

Mr. Keeping has given a number of demonstrations in the Museum on the Tertiary Fossils, as follows :—

July 11th	"On the English Fens."
,, 25th	"Some of the Pre-historic and Pleistocene Bones exhibited in wall cases 15—24."
Aug. 8th	"Caves and their contents."
,, 29th	"The Crag of Suffolk and its fossil contents."

Also he has conducted excursions of Members to the following places of Geological interest—Strensall (deep boring), Settrington, Castle Howard, Hutton.

The following papers were read at the Monthly Meetings :—

March 7th	"The forms, distribution, and habits of Fresh-water Mussels in the York Rivers," by the Rev. W. C. Hey, M.A.
April 4th	"The Roman Statue found in York," by the Rev. C. W. King, M.A., Trinity College, Cambridge.
Nov. 7th	"Some Facts and Theories about our Banded Snails," by the Rev. W. C. Hey, M.A.
Dec. 5th	"On the Geology of the Sections exposed in the new Railway Cuttings at Drewton, near South Cave," by W. Keeping, M.A., F.G.S.

The Society has lost by death during the past year 15 Members, by resignation, 11, and 2 Lady Subscribers have also resigned, whilst 16 New Members, 4 Lady Subscribers, and 6

Temporary Members have been admitted. Amongst deceased Members the names of the Venerable Archdeacon Hey, W. C. Anderson, Esq., Dr. Shann, the Rev. George Rowe, and the Rev. R. Daniel stand prominent, and their loss will be deeply felt by the Society. The Venerable Archdeacon Hey had been a Member of our Society for upwards of forty years. In the year 1841 he became a Member of the Council, and a few years afterwards he was elected to the office of Vice-President, which he held at the time of his death. During that long period he was ever the good friend of our Society in promoting its usefulness and assisting in the management of its affairs. Although his time up to the close of his life was largely drawn upon in discharging the varied duties connected with the offices and dignities which he held in the Church, he ever took a deep interest in all matters of Science connected with the Society, and his loss is felt as a great one among many kindred Societies in the City of York, as well as in the Church in which he presided so ably as one of the Archdeacons of this large Diocese.

Dr. Shann was a Member of our Council at the time of his death, and had on previous occasions discharged the same office. He filled many honourable offices in the City of York, was Honorary Physician to the York County Hospital, and a Justice of the Peace for the City. During a long life he was held in the highest esteem by his fellow citizens, and his loss will be deeply felt amongst the poor of the city to whom at all times he was a benefactor, attending to their wants in the most generous manner.

W. C. Anderson, Esq., like the preceding member Dr. Shann, belonged to the Medical Profession and was a native of York. At the first outbreak of the Cholera in 1831 he greatly distinguished himself by his zeal in alleviating the sufferings of the poor during the continuance of the pestilence. He afterwards became connected with the York School of Medicine, and for many years, and during the time of its continuance, was one of the Lecturers there. Upwards of twenty years ago he became a Member of the Yorkshire Philosophical Society and was always ready to lend a helping hand in promoting its welfare. In 1853 he was elected by his fellow citizens to discharge the office of Sheriff for the City of York, and was subsequently appointed by the Lord Chancellor one of the Justices of the Peace for the same City. He was on more than one occasion a member of our Council.

The Rev. George Rowe, the late Principal of the York Training College, during his residence in York was an active member of our Society. He had on several occasions served on our Council and had taken a very active interest in all that concerned it. He had from time to time given various Lectures to the Members of the Society which were highly appreciated, and at the time of his death he filled the office of Honorary Librarian to the Society, and only a short time before his death he had taken steps to draw up a scheme for its better management and usefulness. Mr. Rowe was for many years the acting Secretary of the Yorkshire Architectural Society, the transactions of which contain many valuable papers of his on Ecclesiological and Antiquarian subjects. Mr. Rowe's death was sudden and unexpected, and his loss will be deeply felt in this Society, and amongst a large circle of friends.

The Rev. R. Daniel for many years discharged the office of Head Master of Archbishop Holgate's School in this city. He also on more than one occasion had been a member of our Council, and actively concerned himself in its affairs. He died at a good old age respected and honored by all with whom he had been brought in contact.

The Council propose for election as Vice-President in the room of the Venerable Archdeacon Hey, deceased, the Very Reverend the Dean of York. The Council propose for election as new Members of the Council, the Rev. M. R. Bresher, the Rev. T. B. B. Ferris, Dr. Tempest Anderson and T. Gough, B. Sc., in the room of the Rev. T. Adams, Edwin Wade, Esq., J. L. Foster, Esq. and W. L. Barnby, Esq., who retire by rotation; and W. Atkinson, Esq., in the room of the Very Rev. the Dean of York, nominated a Vice-President of the Society; and John Teasdale, Esq., M.A., in the place of Dr. Shann, deceased. The latter two are only elected for one year, but are eligible for re-election.

THE TREASURER IN ACCOUNT WITH
THE YORKSHIRE PHILOSOPHICAL SOCIETY
FOR THE YEAR 1882.

Dr. INCOME.

	£.	s.	d.	£.	s.	d.
Subscriptions:						
Members	660	0	0			
County Members	43	0	0			
Lady Subscribers	71	0	0			
Associates	19	0	0			
Temporary Members	6	0	0			
Arrears	8	5	0			
Admission Fees:						
Paid in Full	15	0	0			
Paid by Instalments	27	0	0			
Keys of Gates	62	15	0			
Compositions in lieu of Subscriptions		,,	,,	912	0	0
Rents:						
Mr. Sykes, Bootham and Marygate Towers	24	0	0			
Mr. Burton, Swimming Baths	40	0	0			
Boating Club	5	0	0			
Fine Art Society	2	0	0			
Water Works Co.	0	1	0	71	1	0
Hire of Tent				43	1	4
Meteorological Department				15	12	0
Whitsuntide Admissions after deducting Expenses				4	13	5
Gate Money				293	13	6
Catalogues and Photographs				15	13	6
				£1355	14	9

EXPENDITURE. **Cr.**

	£.	s.	d.	£.	s.	d.
Crown Rent				1	0	0
Corporation Rents				19	11	8
Rates and Taxes				26	10	5
Water Rates				5	2	6
Insurance				5	2	6
Salaries and Wages:						
Mr. Keeping	200	0	0			
Mr. Guy	25	0	0			
Mr. Fielden	60	0	0			
Miss Baines	39	0	0			
John Davison (Pension)	26	0	0			
Attendants, Museum	63	16	0			
Do., Hospitium	26	0	0			
Gardeners	149	15	0	589	11	0
Interest to Insurance Company, less Tax	74	3	10			
Interest to Bankers	81	6	9	155	10	7
General Expenses and Repairs.						
Museum and Hospitium	86	15	0			
Dove & Sons for fitting windows and doors with Iron bars	28	17	8	115	12	8
Estate				23	11	9
Gardens:						
General Expenses & Repairs	45	6	8			
Seeds	4	19	6			
Coal and Coke, &c.	13	16	2	64	2	4
Grass, Sods, Carting, Shrubs, and New Seat, &c, for New Ground adjoining St. Mary's Lodge				34	9	0
Library: Books and Binding				27	12	0
Miscellaneous:						
Printing and Stationery				29	6	11
Printing Reports	11	10	0			
Do. Circulars and communications to Members	9	3	0			
Postage of ditto	18	10	1	39	3	1
Coals, Gas, &c.				41	6	9
Bands				9	12	1
Purchase of Antiquities, &c.				61	3	3
Repairs, Carriage, and fixing Tent				20	1	8
Meteorology				15	12	0
Lectures				12	12	0
				1296	14	2
Excess of Income over Expenditure				59	0	7
				£1355	14	9

	£.	s.	d.	£.	s.	d.
Balance due to the Treasurer, 31st Dec., 1882				1583	14	9
Permanent Debt:						
Yorkshire Insurance Company	1900	0	0			
Due to Two Members	100	0	0	2000	0	0
				£3583	14	9

	£.	s.	d.	£.	s.	d.
Balance due to the Treasurer, 31st Dec., 1881				1642	15	4
Less excess of Income over Expenditure				59	0	7
Balance due to the Treasurer				1583	14	9
Permanent Debt:						
Yorkshire Insurance Company	1900	0	0			
Due to Two Members	100	0	0	2000	0	0
				£3583	14	9

Audited and found correct, York, February 2nd, 1883,

E. GRAY,
Hon. Treasurer.

W. L. NEWMAN.

NEW MEMBERS.

Brown, Rev. Wm., *St. Wilfrid's.*
Crawhall, George, *Burton Croft.*
Cunningham, Major C., *The Crescent.*
Dodsworth, E. R., *St. Peter's Grove.*
Dale, R. P., *Burton Cottage.*
Hey, Rev. John, *Clifton Villa.*
Hotham, Miss C., *St. Leonard's.*
Leng, J. P., *Coppergate.*
Relph, Assistant Commissary General, *Grosvenor Terrace.*
Smith, Rev. Thos., *Clifton.*
Scholfield, Miss, 4, *St. Leonard's.*
Scott, John, *Lord Mayor's Walk.*
Thorp, H. B., *Clifton.*
Walker, Col. D. C., *Club Chambers.*
Watson, Mrs., *Feversham Terrace.*
Wigglesworth, R., *York.*

LADY SUBSCRIBERS.

Blanshard Miss, 26, *Castlegate.*
Daniel, Mrs., *Grosvenor Terrace.*
Dodsworth, Miss, 3, *Museum Street.*
Thomas, Mrs., *St. Mary's.*

RESOLUTIONS

PASSED AT THE ANNUAL MEETING, FEBRUARY 6th, 1883.

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1. That the Report of the Council now read be adopted and printed for circulation amongst the Members, Lady Subscribers, and Associates.

2. That the thanks of the Society be given to the Members of the Council retiring from office, also to the Treasurer, Secretary, and Curators for their valuable services; and that authority be given to the Council to give admission to the public to the Museum on Whit-Monday and Tuesday, under the same regulations as last year.

3. That the thanks of the Meeting be given to the Chairman.

DONATIONS TO THE MUSEUM AND LIBRARY.

LIBRARY.

Books Presented.	Donors.
The Journal of the Linnæan Society....	Mr. W. H. Rudston Read, M.A.
Report of the Whitby Literary and Philosophical Society	The Society.
Atti della Reale Accademia dei Lincei ..	The Academy.
The Journal of the Chemical Society ..	The Chemical Society.
Memoirs of the Geological Survey of India, ser. xiv., Duncan & Sladen....	The Indian Government.
Address at the Anniversary Meeting of the Norwich Geological Society by J. H. Blake, F.G.S...	The Author.
A Chapter in the Life History of an Old University, by the Rev. Professor Bonney, F.R.S.....................	The Author.
Report of the Meteorological Council, 1880—1	The Meteorological Council.
Sur la délimitation et la constitution de l'étage houiller inférieur de la Belgique par le Dr. J. C. Purves	The Author.
Catalogue of books added to the Radcliffe Library during the year 1881........	The University of Oxford.
The Transactions of the Linnæan Society of London, Botany, vol i., pt. ix., vol. ii., pt. i.; Zoology, pt. ii., iii. & iv.	Mr. W. H. Rudston Read, M.A.
Geology of India, part iii.; Economic Geology, by V. Ball, M.A.	The Indian Government.
Records of the Geological Survey of India, 2, 3, 4, 1881	The Indian Government.
Memoirs of the Geological Survey of India, vol. xviii., 1, 2, 3	The Indian Government.
Palæontologia Indica, 2 vols., by Waagen and Feistmantel	The Indian Government.

Books Presented.	Donors.
British Fossil Cephalopoda, part I., by Rev. J. F. Blake	Mr. Wm. Reed, F.G.S., Blake Street.
Fresenius' Chemistry	Mr. Wm. Reed, F.G.S.
Engravings of the Ancient Marbles in the British Museum	The British Museum.
Barrande's "Acephales"	The Author.
Transactions of the Royal Society of Edinburgh	The Royal Society.
British Conchology, vols. i.-v., G. Jeffrey	Mr. Wm. Reed, F.G.S.
Memoirs of the Geological Survey of Great Britain, vols. i.—xiii.	Sir A. Ramsay.
Annual Report of the British Museum	Museum Council.
Report of the Scarborough Philosophical and Archæological Society, 1881	The Society.
Smithsonian Report, 1880	The United States Government.
Seven Photographs of the remains of large New Zealand Birds	Prof. T. J. Parker, Otago University, Dunedin.
Transactions and Report of the Council of the Leicester Literary and Philosophical Society	The Society.
Report of the Norwegian North Atlantic Expedition, vols. iv. and v.	The Norwegian Government.
Geological Papers by Walter Keeping, M.A.	The Author.
Annual Report of the Leeds Literary and Philosophical Society	The Society.
Meteorological Reports, viz.: The Storm of October, 1881; Observations at Stations of 2nd Order, 1879; Reports on the Neighbourhood of the Cape of Good Hope	The Meteorological Society.
Proceedings of the Norwich Geological Society	The Society.
Proceedings of the Warwickshire Field Club	The Society.
The Ventriculidæ of the Chalk, by J. Toulmin Smith	Miss Toulmin Smith.
The Calendar of the Yorkshire College	The College.

Books Presented.	Donors.
Catalogue of the Antiquities at Alnwick Castle (Illustrated), and Catalogue of the Egyptian Antiquities at Alnwick Castle, 2 quarto vols.	The Duke of Northumberland.
The Proceedings of the Royal Institution of Great Britain, vol. ix., parts 4, 5 ..	The Royal Institution.
The Journal of the Chemical Society....	The Society.
Bulletin of the United States Survey of the Territories, vol. vi., No. 3	The United States Government.
Dana's Manual of Geology, 3rd Edition	Wm. Reed, Esq., F.G.S.
List of Correspondants of the Smithsonian Institution, 1882	The Smithsonian Institution.
Contributions to the Meteorology of the Arctic Regions	The Meteorological Council.
Report on the Gales Ocean District	The Meteorological Council.
"Geodätische Arbeiter," vols. i., ii., iii., and "Vaudstand's Observationer," vol. i.	The Norwegian Government.
The Annelida of the Norwegian North Atlantic Expedition, and the Holothurida	The Norwegian Government.
The "Quarterly Weather Report," 1879. Appendices and plates, and "Hourly Readings," January to March, 1881 ..	The Meteorological Society.
Memoirs, vol. xix., pt. 1, and Records, vol. xv., pts. 1—3, of the Geological Survey of India; also Palæontologica Indica, ser. x., vol. ii., pts. 1—3, and series xiv., vol. i., pt. 3 (Fasc. 2)	The Indian Government.
Geological and Geographical Atlas of Colorado, and adjacent Territories, by Dr. F. C. Hayden..................	The United States Government.
Report of the Meteorological Council to the Royal Society, 1882	The Meteorological Society.
Instructions for Meteorological Telegraphy, 1883......................	The Meteorological Society.

MUSEUM.

GEOLOGICAL DEPARTMENT.

	Donors.
Vertebra of an *Ichthyosaurus* from Market Weighton	Mr. J. S. W. Kirkpatrick.
Specimens of Mollusca from the Inferior Oolite	Mr. J. F. Walker, M.A., Gillygate.
Several *Ammonites* and other fossils from the Kelloway Rock of Drewton cutting, near S. Cave	Mr. A. J. Barry.
A stalagmitic deposit from a ditch at Sutton, near Thirsk	Mr. F. Rawling, Sutton.
A series of Brachiopods from the Wenlock shale of Buildwas and Tickwood, Salop	Mr. J. F. Walker, M.A.
Tusk of a Hippopotamus, from the gravel at Nunnington	Rev. Canon Raine, M.A. D.C.L.
Section of tooth of *Elephas* and tooth of Mastodon	Rev. E. A. Healey, Copmanthorpe.
107 specimens from the Middle Lias of Grosmont	Mr. Wm. Reed, F.G.S.
A large Sponge, "petrified" by the springs at Knaresborough	W. H. Huddleston, Esq., Cheyne Walk, Chelsea.
Fossils from the Kimmeridge clay of Thornton-le-Dale, also from the Lias and Lower Calcareous grit	Mr. G. Edson, Malton.
Carpolithes Bucklandi, a fruit from the Coralline Oolite of Malton	Mr. Jackson, Malton.
Four species of Shells from the Kelloway rock of S. Cave	Mr. C. S. Middlemiss, B.A., Hull.
A *Calamite* Stem from S. Kirby, near Pontefract	Mr. C. D. Wolstenholme
Ammonites capricornis and other fossils from the new railway cutting near Brough (Hull and Barnsley line)	Mr. J. E. Jones, South Cave.
Two *Ammonites* from the Oxford clay, and a cast of *Calymene Blumenbachii*	Rev. E. A. Healey, Copmanthorpe.
Fibrous Gypsum from the Drift at Gate Helmsley	Mr. F. Wright, Stamford Bridge.

	Donors.
Septarian Concretion from Settrington,	Rev. I. Taylor, M.A., Settrington.
Fossil Echini and Brachiopods from the Upper Chalk, near Six Mile Bottom, Cambridgeshire	Mr. W. Keeping, M.A.
A series of Rocks from Norway, and Fossils from the Cambrian Rocks of Malmö and Christiania	
Fossils from many Yorkshire localities, including the Lias of the coast of Grosmont and Cliffe, the grey and yellow sand series of the Peak and Glazedale, the Kelloway Rock of the Cave district, etc., collected by Mr. W. Keeping, M.A.	
A choice and important selection of Fossil Sponges, Echinoderms, Mollusca, etc., from the chalk of Yorkshire	Mr. S. Chadwick, Malton.

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ZOOLOGY.

Several Skulls of Turtles, Camel, and Bos	Dr. T. Anderson, Stonegate.
Two Recent Corals	Dr. C. H. Dunhill, Minster Court.
Procellaria puffinus, the Manks Shearwater	Rev. C. R. W. Waldy, M.A., Sutton-on-Derwent.

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BOTANY.

30 Plants have been presented to the Society by W. H. Rudston Read, Esq., namely :—

Palms.

Brahea filamentosa
Corypha Australis
Livistona sinensis
Chamærops humilis
Phœnix rupicola
Seforthia elegans

ORNAMENTAL FOLIAGED PLANTS, ETC.

Coleus "Allan Chandler"
,, "Glorie de Monceux"
,, "Nimrod"
,, "Lovely"
,, "The Queen"
Abutilon Reine d'or
Begonia, tuberous rooted

Pandanus utilis
Asplenuim Fabianum
Gloxinias (seedlings)
Lantana "Gizelle"
,, "Ver Luisant"
,, Reveil
Begonia insignis

HARDY HERBACEOUS PLANTS.

Veronica Guthriana
Auriculas (alpine)
Delphiniums (of sorts)
Primula Sieboldii alba
Dahlia Cervantesii

Phlox setacea atropurpurea
Saponaria ocymoides splendens
Tiarella cordifolia
Primula Sieboldii
Dahlia coccinea

ANTIQUITIES.

	DONORS.
Two poisoned Arrow Heads	Mr. J. S. W. Kirkpatrick
A curious Leaden Weight, found at Langton, and two Heads in pottery, probably from Cyprus	Rev. C. B. Norcliffe. Langton Hall.
A fine fluted Urn, found in Newington Place	Mr. C. N. Wilkinson. Newington Place.
A box of ancient Gold Weights & Scales	Mr. George Acton, Low Ousegate.
Anglian Spear Head and Knife, from Londesborough	Lord Londesborough.
Several Anglian Implements in bone, found in Davygate	Mr. Alderman Melrose. Clifton Croft.
A pair of silver Shoebuckles and a Denarius of Philip	Mr. H. Preston, Bootham Terrace.
Seven bronze Medals and a silver coin of Alexander VIII.	Major J. A. Barstow, Garrow Hill.
Pottery and other curiosities found under his house in Petergate..............	Rev. C. B. Norcliffe, Langton Hall.
A Nurembergh token or counter......	Mr. W. W. Hargrove, Clifton.

	Donors.
A large Stone Weight, with handle inscribed H. S., 1636	Mr. Hugh Christie, Melbourne.
A curious Chain found recently under the Union Bank	Mr. St. Clair Carnegy, Union Bank.
Two Gold Weights and a Medal commemorating the anniversary of the Revolution of 1688	Mr. J. F. Walker, M.A., Gillygate.
Thirty-five bronze prehistoric Implements and Weapons, consisting of axes, palstaves, daggers, etc., from England and Ireland; also several Implements of Stone of the same period from the West Riding of Yorkshire	Mr. Edward Hailstone, Walton Hall, Wakefield.
Two very fine bronze Roman Bowls, found early this century at Finningley, near Doncaster. Within each there is another of a thinner material, with a jimped edge, as if to protect it	
A finely-ornamented patera of Samian Ware from York, with many potter's marks on Amphoræ, Mortaria, and Samian vessels	
A Torch-Stand, two Vessels, and a Lamp, from Trier, all of bronze and of Roman work	
Six very fine Roman Vessels from Trier, two of which have inscriptions around them in white slip	
Fourteen Vessels of Romano-Greek Ware	
Three Lamps from Carthage, with the Christian monogram upon them, and two Charms against the Evil Eye, from Trier	
Two Danish Combs found in York, and two mediæval Vessels from the same city; another Vessel from the moat at Walton Hall	
A very fine Circlet from Ireland, covered with interlacing work and rich ornamentation	

	Donors.
A collection of nearly forty brass Matrices of Seals, chiefly foreign; a large number of original impressions of the Royal Seals of England, and a very large quantity of Doubleday's casts of English and other Seals	Mr. Edward Hailstone, Wakefield.
The Skull of Theodorianus of Nomentum, taken out of a stone coffin found on the Mount circa, 1800. The inscribed Coffin is in the collection of the Society	Mr. W. Driffield, Huntington.
A Roman Urn, ornamented with a hunting scene, found in Blossom Street....	Lady Clark, South Parade.
Two Bullets, a Glass Bead, etc., found at St. Michael-le-Belfrey when it was restored	Rev. C. B. Norcliffe, Langton Hall.
A British Stone Axe, perforated, found at Norton-in-the-Clay	Dr. A. H. Leadman, Borobridge.
The George Alderson Robinson collection of Antiquities, etc. (See page 10).	
Heliostatic Clock	Mr. Foljambe.

SERIAL WORKS SUBSCRIBED FOR.

Birds of Asia, by John Gould, F.R.S.
Natural History of the Tineina, by H. T. Stanton, F.R.S.
Nautical Almanack.
Proceedings of the Zoological Society.
Publications of the Palæontographical Society.
Publications of the Ray Society.
Sowerby's Thesaurus Conchyliorum.
London, Edinburgh, and Dublin Philosophical Magazine.
Annals and Magazine of Natural History.
Geological Magazine.
Journal of the British Archæological Association.
Numismatic Chronicle.
Memoirs de la Société Paléontologique Suisse.
D'Orbigny's Paléontologie Francaise.
Geological Record.
Nature.
Surtees Society, the Publications of.
Hardwicke's "Science Gossip."

COMMUNICATIONS
TO THE
MONTHLY MEETINGS
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY,
1882.

March 7th, 1882.—The Rev. W. C. Hey, M.A., read the following paper on "Fresh-water Mussels in the York Rivers." The Ouse and the Foss, which unite just below York at the spot known as the Blue Bridge, are rivers of very different character, much more so than the superficial observer would suppose. The Ouse is a wide, deep, and generally rather a rapid river, sometimes, in floods, almost a torrent. The Foss is a narrow river, naturally shallow, though in parts deepened artificially, and the current flows so gently that often the water is practically stagnant. Again, the Ouse has a very bare channel somewhat hard and stony in places, and even where the bottom is soft and sandy there is no vegetable growth. But the Foss has a bottom of rich soft mud, where the flags and the water-lilies root themselves and flourish luxuriantly. In places the river is quite overgrown with tall rushes in summer time. Again, the Ouse receives a good deal of drainage, the Foss not much, except one very poisonous kind, viz., that which escapes the Gas Works. Once more, near York the Ouse has no locks. This is a very important point to notice in regard to the distribution of species. But the Foss has three locks within the space of as many miles viz., Castle Mills Lock, Yearsley Lock, and Huntington Lock. Asking you to bear in mind these points of contrast between the Ouse and the Foss, I go on to make a few remarks on the genera and species of mussels found in these rivers. The family of *Unionidæ* or freshwater mussels is represented in England by two genera, viz., *Unio* and *Anodonta*. This is the distinction between them. In *Unio* the hinge, or point upon which the valves work, is supplied with projections known as teeth, and corresponding receptacles. In *Anodonta* the hinge-line is quite smooth and toothless. There are three kinds of *Unio* found in England—firstly the famous pearl mussel, which is confined to mountain streams, and therefore does not occur at York; secondly, *Unio pictorum*, so-called because painters used the shell for palettes; and thirdly, *Unio tumidus*. The last two occur in both our rivers. In the genus *Anodonta*, Jeffreys makes two species, *Anatina*, in which the hinge line is carried into a sort of crest, and *Cygnæa*, which has the hinge line almost parallel with the other edge of the shell. This distinction, however, is difficult to preserve; one form passes by imperceptible grades into another. Both forms occur abundantly at York. The mussels can be collected in plenty only when the locks are open. The water then sinks sufficiently low to disclose large numbers of them sticking in the soft banks. When Naburn Lock is opened that small portion of the River Foss (only some 200 yards in length) which lies between Castle Mills Lock and the Blue Bridge is almost drained. Very near the mouth of the Foss occurs a number of mussels belonging to the species *Anodonta anatina*. They are remarkable for possessing a beautiful ornamentation of rich green rays. The epidermis is lustrous, the interior highly nacreous. Now, by walking a few yards we find ourselves following the bank of the Ouse. Here occurs the very same form of *Anodonta*, but how changed in appearance! Instead of a lustrous green epidermis the shell is of a dark dead brown colour, the pearliness of the interior is quite dull, and the phenomenon of erosion, or the eating away of the epidermis and upper layers of the shell, is extensively developed. Erosion is caused by the presence of carbonic acid or by the rapidity of the current of water. Probably the former has caused the disfigurement of the Ouse Anodontas, owing to the drainage matter present in the river just below York. Exactly the same contrast is shown in the specimens of *Unio pictorum*, from the same two localities, with the additional distinction that the Ouse specimens have a slightly curved form, and belong to the variety termed *curvirostris.* Between Castle Mills Lock and Layerthorpe Bridge Anodontas are more or less abundant, but they no longer present the beautiful radiated colouring which distinguishes the Blue Bridge specimens. Drainage affects the colouring unfavourably, but in certain parts improves the size. There was, and perhaps is still, a spot where warm water was discharged into the river. At this point the shells were observed to be larger and more delicate than elsewhere, exemplifying the general effect of heat upon forms of life. At Layerthorpe Bridge shells cease to exist in the river. This is due to the poisonous matter percolating through the banks from the Gas Works. However, immediately above Monk Bridge, another species of *Unio* appears, and is more or less abundant from that spot up to Yearsley Lock. This species is *Unio tumidus*; and what is remarkable about it is that it appears in two forms—one a thick, dark brown wedge-shaped form; the other a thinner, wider, and greenish-tinted form. Why the same species should be present in two forms under exactly the same circumstances is a puzzle, for it is a generally received law that where two different forms exist under the same conditions each has a right to be elevated to the dignity of a species. And this is a law I should like rigidly to adhere to, for I conceive it to be one of the few thoroughly scientific criterions of a species. Near the bathing place in the Foss, there exists, though it is very scarce, a curious form of *Unio*, which in the "Journal of Conchology" I described as *Unio tumidus.* I now believe it to be more correctly referred to *pictorum.* The shell is large, very heavy, much truncated, and in colour a dark olive brown.

Above Yearsley Lock we find a great change in the form of the toothless mussels. The form *cygnea,* in which the sides of the shell are parallel, takes the place of the crested form, which, according to my experience, is universal in the lower reaches of the river. The colour of the shell is a clear rich olive or sepia, and the beak is much protruded. It seems strange that the locks should separate forms of shells as completely as they do, for two circumstances must be borne in mind. The first is that a good deal of water passes round by what is called the backwater, especially in flood time; and the second, that the locks were once often opened, and have not, of course, existed from a very remote time: so that we seem here to have a striking example of the readiness with which forms of life are restricted in distribution and affected in shape and colouring. The same restriction of distribution and modification of form is exemplified in the river Foss in the case of many other species of freshwater shells. Thus a particlar form of *Sphærium lacustre* predominates only near Foss Islands, while another species, *Sphærium ovale*, occurs nowhere within miles of York except in the tiny space between the Castle Mills Lock and Blue Bridge, and what is still more strange, had never been found either there or anywhere else in England till within late years. Mr. Jeffreys has a theory that it was imported from America, but no communication, so far as I am aware, has ever existed between our River Foss and any vessels which have crossed the Atlantic. The coal barges of the Foss would be a sorry sort of craft in which to stem the billows which roll between England and America, and I am not aware that anything larger has in modern times floated upon its waters, nor even that any American export is ever brought up the river.

A few special forms of freshwater mussels deserve notice. Just above Yearsley Lock occur some dwarfed and malformed specimens of *Unio tumidus*. This malformation I venture to attribute to the effect of the water rushing over the dam. Rapidly running water is always deleterious to the development of such shells as generally affect still waters. Near Clifton Scope occur some very thin, but bright and clean, Anodontas, only small in size. They are clean, doubtless because of the absence of drainage, and they are small and thin because, not only is drainage absent, which often affords rich food, but the river is very clear of vegetable matter. Near the Union, there occur in the Foss, shells of *Unio tumidus* much curved in form. They resemble *Unio margaritifer* in shape. It is curious that all our British Unios and Anodontas have a tendency to assume this form under certain circumstances.

These investigations, made over a space of a dozen years or more suggest a few general reflections. The first reflection bears on distribution; that subject which the genius of Wallace has rendered so deeply interesting. For the fact of so temporary and incomplete an obstacle as a lock forming a boundary line between varieties, and even kinds of shells, gives us some limit about the apparently small lines of demarcation which may determine the complete range of species and even genera upon the surface of the globe. Our second reflection is upon the instability of species, and the impossibility of any cut-and-dried definition of the term. Of course a natural history which ignored species would be as absurd as a thermometer ungraduated —only species are best regarded in the same light, merely degrees marked upon the unbroken flow of life. The third reflection is how species are affected by a change of circumstances, and that, though the change is often far from being very obvious. No one would suppose that the difference in the quality of the water in the Ouse and the Foss is so great as the difference between the two forms of *Anodonta* living within a few yards of one another shows it to be. A superficial and special view of any department of natural history leads to the conclusion that Nature has, as it were, a number of moulds from which she is never tired of producing the same forms. A wider and more general view, extending to past geological epochs, reveals the great fact, that as the individual, so too the species and the genus, have their birth, their vigour, their decay, and their death, and that natures moulds themselves are as impressionable as the receiving surface of the photograph—not one external influence but evokes a corresponding modification.

April 4th, 1882.—In the absence of the Author, the Rev. Canon Raine, M.A., read a paper by the Rev. C. W. King, M.A., Trinity College, Cambridge, on "the Roman Statue found in York, in 1880."—The statue of some personage arrayed in complete Roman armour, lately discovered at York, is incomparably the finest example of Roman-British workmanship that we possess, from its excellent style, exceptional magnitude, and wonderful preservation. What adds immensely to the interest of the relic is the assurance that it was the production of native skill and not an importation from a region more advanced in culture (which its merit might otherwise cause us to suspect), for its material places this interesting fact entirely out of doubt, being the fine-grained gritstone of the actual neighbourhood.

On its intrinsic value as a monument of ancient sculpture, all critics are agreed—but as to the idea the sculptor had in view—whether a god, a tutelary genius, or a mortal—there exists a very wide diversity of opinion; and although each theory finds support in some particulars of the representation, yet each in turn is controverted by other portions of the accessories that strongly militate against it. To examine these interpretations successively, and to state the arguments suggested by the work itself for and against each of them, is the object of the present paper.

The most obvious explanation of the meaning of the figure is that we have in it the portrait of some very youthful Cæsar, represented in his proper character of "*imperator*" as best befitted the requirements of the place where it was to be honoured—the important military station of Eburacum. That such representations were usual in this island is attested by the beautiful bronze statuette of Nero haranguing his troops, 22 inches high, and exhumed at Barkinghall, in 1790, now deposited in the British Museum. The cuirass, indeed, now wants that indispensable badge of imperial dignity, the Gorgon's head, of which Martial makes such ingenious use:—

Accipe belligeræ crudum thoraca Minervæ,
Ipsa Meduseæ quem timet ira comæ:
Dum vacat hæc, Cæsar, poterat lorica vocari,
Pectore cum sacro sederit, ægis erit

Nevertheless the marks of its attachment to the metal are still perceptible. But the breast of our statue was never graced with this distinctive ornament, neither are the legs covered with the *caligæ*, that equally indispensable part of the Roman military costume, but, on the contrary, with the metal greaves of Greek Heroic times, the use of which had grown entirely obsolete in actual service long before the conquest of Britain. The Roman *imperator* invariably appeared in his statue in the same equipment as that in which he marched in front of his army, or harangued them before a battle. These two circumstances are, therefore, sufficient in themselves to upset the first identification of the character of the statue.

The second, which makes it to be a Mars, has much to be said in its favour; but yet is open to certain grave objections that do not present themselves to the casual observer in so glaring a light as those above adduced against the previously quoted opinion, but which will be found the more difficult to rebut the more closely they are examined. It is true, indeed, that our figure still rests one hand on his shield, and the other, though now deficient, unquestionably upon his spear, in the attitude of that god when "standing at ease," as opposed to his violent action in his other characters of "*Gradivus*," and "*Propugnator*,"—but this is nearly all that can be said in support of the attribution we are now considering. The very youthful, nay feminine cast of the features, and the long flowing hair would rather bespeak a "Venus Victrix," than the ferocious Mavors of the Romans, who invariably typified their Divine progenitor as a bearded man, arrived at the maturity of his strength; and this from the earliest times as may be seen from the head of Mavors placed upon the beautiful *scriptuli* of the Republic. It is however true that the Ares of the Greeks, (and consequently, of their scholars, the Etruscans) enjoys perpetual youth upon their monuments; and the thought once occurred to me that the maker of our figure had chosen to take for his model some ancient masterpiece of the Greek school, a bronze statuette of Ares, carried about from one country to another amongst the lares of his Roman patron: just as the Table-Hercules of Alexander always accompanied Hannibal in his campaigns, and afterwards, under the Flavian dynasty, its latest possessor, Pollius Felix, (Statius, Sylvæ, iii. 1). Although the exceptional merit of the York sculpture would warrant our assigning it an origin of this nature, yet it exhibits certain peculiarities in the detail (hereafter to be noticed) that plainly indicate a widely different nationality and date for its execution.

The third explanation of its design, that proposed by Mr. Thompson Watkin, (Archæological Journal for December, 1881), is equally ingenious and seductive; and if it should pass the test of severer scrutiny, would supply our country with a national type far more elegant and expressive than that which has so long enjoyed the same honour.

He discovers in the figure the *provincia Britannia* personified, and finds, what certainly is strong support, the base of a statue, now unhappily lost, from the same locality, bearing a dedication to that divinity; "*Britanniæ sanctæ P. Nickomedes Augg, n. n. libertus.*"

Let us now discuss the arguments supporting this view of the question, that are presented by the sculpture itself. The body-armour, it is true, is entirely Greek, or else copied from a Grecian prototype, but the shield is neither the circular Hellenic ἀσπίς, nor the rectangular Roman *scutum* of the legionaries, nor the small round *parma* of the cavalry. There can be no doubt that it represents the great Gallic shield of *wood* if we compare it with those depicted on the arms of the Gauls in the combats with them, which form a frequent reverse of the consular *denarii*, notably those of the *gens Servilia*, and which distinguished the Gallic nationality down to the close of the Empire, for Ammian notices how Julian's Gauls were enabled by their means to swim across the broad Euphrates. The coin-types shew that the distinctive feature of these shields, (like doors, θύρεοι as Diodorus Siculus calls them), was the large, hemi-spherical *umbo* in the centre, intended to protect the hand which wielded it, and which is equally conspicuous in the monument now under consideration. But the part that betrays a barbaric origin even more unmistakably than the Celtic shield, is the sword, whose pommel reaches to the left armpit of the warrior, whilst the sheath descends as low as his knees. Entirely dissimilar to the short and wide Roman *ensis*, it is the veritable *spatha* of the Gauls, "equal in length to the darts of other nations," as the same Diodorus remarked in the days of Augustus (Hist. v. 30). It is, undoubtedly, an example of the "*enormes et sine mucrone gladii*," which Agricola encountered in the hands of the Britons, and which were used for slashing at the heads and limbs of their opponents (Polyb. Hist. ii. 33), according to the regular Gallic system as described by Polybius. For the more civilised part of the natives of the island differed but slightly in manners and customs from those of the opposite continent, whence they had come over (as Cæsar tells us); it therefore necessarily follows that the arms of the Britons, offensive and defensive, were the same as those used by the Gauls.

Another point in favour of Britannia's claim to the appropriation of this statue, in addition to the feminine face and head which it appears to exhibit, may be found in the fulness of the chest and the very peculiar (and perhaps significant) ornamentation of the cuirass, which might seem to indicate the existence of female forms beneath their covering. This last observation, however, may be objected to—for it cannot be denied that the slenderness or compactness given to the human figure depends more upon the period of art than upon the actual proportions of the model. Nothing stronger than the above-stated arguments can be advanced in support of Britannia's claims to this personification; and notwithstanding one's natural anxiety that she may gain her suit, and the proverb, "*Male verum examinat omnis corruptus judex*," it must be confessed they are of no great weight when the arguments on the other side come to be carefully examined.

The base, above mentioned, proves, it is true, that the tutelary genius of our island was embodied in a visible form, and like Dea Roma, or the Τύχη of Antioch, received divine honours from the civilised natives, but numerous memorials of the period too clearly declare that the form under which she was worshipped differed in every respect from the one before us. Our authorities for the personification of Britannia are the coins of Antoninus Pius (apparently from their rude make struck in the island), of Hadrian, and, a century after him, of Carausius. The first depicts her as a figure in profile, seated on rocks, holding a military ensign in the right hand, and resting the left, which supports a spear, upon the edge of the great Gallic shield. The second, more artistic in design, exhibits her similarly seated, but in front face, resting her head pensively on her right hand, and the left armed as before, upon the same shield, but of even larger relative proportions, and with a long spike projecting from the *umbo*. In neither case does she wear any body-armour, in fact as the Gauls used none, but went into battle "naked," with the shield for their sole defence, it was impossible that the Britons should have advanced beyond them in that particular, and, what proves the point, is the bas-reliefs of local workmanship (the finest being that lately found near Linlithgow), where the victorious Roman is seen careering over prostrate barbarians all in a state of nudity, for they had cast off the plaid, their only covering, on rushing into battle, as did the Highlanders in similar circumstances, or even when engaged in any hard work down to the time of the construction of the military roads after the rebellion of 1745. But most interesting of all these types is the Britannia welcoming her *soi-disant* saviour Carausius, upon his landing, with the Virgilian quotation, "*Expectate, veni.*" But in this last picture, to suit the occasion, Britannia appears, without weapons or defence, in the usual attire of a Roman matron grasping the hand of her new sovereign. The wall of rocks that first met the eyes of the invaders from the other side of the Channel was, therefore, taken for the distinct badge of Britannia, according to the rule in Roman personifications, just as Italia on the coins of the Social League is distinguished by her peculiar Samnite lance, and the reclining bull, *vitulus*, that gave her name; Hispania, by the rabbit, for the same reason; Africa, by the elephant's head; and Dacia, by the great Celtic trumpet, *carnynx*, carried in her hand. Had the York statue, therefore, been designed to typify this island, the natural distinction of the country would have, as a matter of course, found its place as an accessory, in the background, as support to the folds of the *paludamentum*.

Some may be inclined to see here Dea Roma herself, than whom no deity could have more appropriately adorned the Prætorian head-quarters in any part of the Empire—but the costume, in this case also, furnishes insuperable objections against, apparently, so satisfactory an explanation. The tutelary goddess of Rome was no other than Minerva, the Etruscan name of the Palladium, *i. e.*, statuette of Pallas-Athene, the special object of veneration to the Pelasgic founders of the City. Now, no extant type of the virgin-goddess represents her in body-armour—the most archaic statuary agrees with Phidias in this particular, in dressing her figure in the long closely-pleated *peplos*, with no other defence than the helmet on her head and the shield held forth on her arm, and, more rarely, the *ægis* round her neck, which she borrows from her father. Such is her regular equipment in Roman art, from the early times of the Republic when her helmeted head, with title Roma is the usual obverse of the coinage, down to the fifth century, when as a neutral party between Paganism and Christianity, she is allowed in the inoffensive character of Urbs Roma to retake her place upon the *denarii*.

The only result of this long discussion is the conviction that, although it is very easy to discover what the meaning of the sculpture is not, it is impossible to decide what it is, and the reader of the foregoing discussion will have good reason to quote the reply of Plautus, "*Bene replicasti, incertior multo sum quam dudum.*"

November 7th.—The Rev. W. C. Hey, M.A., read a paper on "Some Facts and Theories about our Banded Snails."

The last paper I had the honour of reading before this Society dealt with the common bivalves of our York rivers. The present paper has for its subject some of the familiar univalves of our hedgerows, commonly denominated snails. The remarks I have to put before you refer to those brightly-coloured shells which appear in such astonishing numbers, sticking to nettles or crawling over grass, when the weather is warm and damp, and vanish in an equally astonishing manner when we have a succession of very sunny or very cold days. The variation in colour of these shells is almost endless. I have gathered in Yorkshire alone about thirty very distinctly marked varieties, and an immense number of less clearly distinguished forms. Yellow or pink is usually the ground colour—sometimes left plain, sometimes decorated with one, rarely with two, often with three or more dark narrow bands. At other times one broad band runs all round. Occasionally the bands are variously interrupted, and specimens at times occur which have the bands bright red, or quite colourless. An interesting question is afforded by considering what is the relation between the animal and its shell. The union between them is so close that although there are plenty of shell-less snails, commonly called slugs, those which possess shells perish soon after extraction, and that although there is no organic union between them.

Has the animal, one would ask, any liberty of choice in selecting the colour of its shell? A specimen I obtained at Redcar throws some light on the subject. It is a banded snail, and has been severely crushed. The snail has repaired the shell. It has retained the shape and the pink colour of the remainder of the shell, but has not been able to re-produce the brown bands. Thus, we may conclude, I think, that each snail can once, without conscious effort, produce a shell of one uniform plan; but that when, from any cause, conscious effort is called forth on the part of the animal, no elaborate previously-begun pattern can be carried out, and convenience and safety is the only thought present to the mind of the utilitarian and unæsthetic mollusc. Another specimen, obtained near Bridlington, shows that this snail can alter the spiral curve of its growth, if desirable—a phenomenon much more common, and naturally so, among the freshwater discoidal shells included under the genus *Planorbis*. The shells before us are divided into two principal groups. The first group is distinguished by the lip being coloured brown, and is called *Helix nemoralis*. The second has the lip white, and is known as *Helix hortensis*. A form with a pink lip also occurs, and has been (with doubtful propriety) called *hybrida*. Few points have been more eagerly discussed by conchologists than the right of these differently-coloured shells to rank as distinct kinds. My own view is that *nemoralis* and *hortensis*, at any rate, form two pecies; *hybrida* may be a form of the latter. The reasons for this view are as follows:—A practised eye may detect a difference in the size and shape, as well as in the colour of the two shells. A typical specimen of *H. hortensis* is smaller and more conical than a typical specimen of *H. nemoralis*. There is also a difference in the texture of the shell. *Hortensis* is the thinner and more transparent. In the second place, the two so-called varieties have never to my knowledge been observed to breed together, and in the third place, although Mr. Jeffreys has made a statement to the contrary, they unquestionably often do live in company.

Now if two forms of a shell, or of any other organism grow together under precisely the same circumstances, they ought to have a good claim to specific distinction, for there is no external circumstance to explain the difference. If we find a large strong snail in a cabbage garden, and a small thin one, bearing considerable resemblance to it, in a barren and limeless district, there may be great reason to expect they are the same species, and that the differences between them are simply due to the different circumstances about them. A snail shell from Guernsey, whose granite rocks are deficient in lime, presents a curious contrast with a snail shell from a limestone district in England. But were two such snails found together in the same cabbage, there would be great reason to suspect specific difference.

It is quite true that the white and brown lipped snails very frequently live apart. To take local illustration, in Skelton Lane you will find only white lips, and I may say the same of Dringhouses, while on the Bishopthorpe Road I have only found brown lips. However, on the Malton Road you will find brown and white lips living together, and in many places about Scarbro', not excluding the Spa, you will find the same thing. From these reasons I am strongly inclined to believe that *Helix hortensis* is a distinct species from *H. nemoralis*.

H. hybrida, the pink lipped form, has the shape, size, and texture of *H. hortensis*, but I must admit I have found it in company with that species both at Scarbro' and York.

Many years ago I noticed a curious habit of these snails which I see has been lately described by Mr. Rimmer in his excellent book on our Land and Freshwater Shells. I was walking through a part of Danes Dike, near Flambro' Head, when the trees presented a most extraordinary appearance, being stuck all over with "happy couples" of pink and yellow snails. I have several times tried to witness this phenomenon again, but have never succeeded, nor can I devise the reason of it. Knowing as we do the partiality of thrushes for these snails, it seems the very climax of suicidal folly for them to go up the trees at such a critical period of their existence.

The causes which determine the colouring of these variable snails are very obscure. Why should nearly all the specimens of *hortensis* up Skelton Lane be yellow, plain or banded, while at Dringhouses they are mostly pink? Why still more should the snails which lived in that little bit of hedge near the footpath from St. Mary's to the Scarbro' Railway Bridge be a remarkable dark liver colour, occuring nowhere else near York, and alas! no longer occurring there, owing to one of those improvements which naturalists lament everywhere? And to add insult to injury, they positively asked me to subscribe to the footpath which has destroyed the haunt of my precious snails. Why again should it please most of the pink Redcar shells to have only one band, while at Burlington that is the form of ornamentation selected by the yellow, and the pink, if they wear bands at all, adopt four or five? Sir John Lubbock is feeling his way to the laws of colour among flowers, but the laws of colour among animals are at present almost entirely unknown to us, and though self-protection may explain the stripes of the jungle-haunting tiger and certainly does explain the colouring of many insects, thousands of instances might be quoted, and among them our pink and yellow snails, where colour rather invites than precludes observation.

Variety of form and texture, however, may generally be accounted for with more or less satisfaction. *Helix nemoralis* and *hortensis* are widely distributed forms, occuring like all our other snails, over a considerable part of Europe. Therefore, as might be expected, they exhibit considerable variety of size and strength. The largest examples of these snails I have seen come from Vevey, on the Lake of Geneva. The warm climate and abundance of lime sufficiently explain their robust character. Specimens from San Sebastian, at the foot of the Pyrenees, are nearly as large. In England, the finest specimens come from the limestone districts of the South. The tiniest examples I have met with come from Knaresbro', near St. Robert's chapel. As the rock at this point is magnesian limestone the reason for their dwarfed character is obscure. They are white lipped, and are not half the size of white lipped specimens gathered near the Forest of Fontainbleau in France.

There is one great reflection which above all others arises to the mind after considering a highly ornamented species like that before us. It is this: Can all the characters of living things be satisfactorily and sufficiently explained on the ground that they were developed by natural selection for the benefit of the species in question? Or is it not a fact that while natural selection has unquestionably been a great agent in the work of development, there are nevertheless to be found in many classes of living creatures, specially among shells and insects, decorations both of colour and sculpture, for whose existence as no natural cause can be conceived of, a supernatural cause is postulated?

December 5th.—Mr. W. Keeping, M.A., read a paper on "The Geology of the new Railway Cuttings in the Cave District, South Yorkshire."

Mr. Keeping said that there are perhaps few areas in England which have been more carefully worked by Geologists than the cliffs of the Yorkshire Coast. Ever since the time of William Smith and Professor Phillips these cliffs have been frequently visited by scientific men, every foot of it has been carefully examined, and many valuable papers on their structure have been published. But much less attention has been given to the interior of the county, where of course good rock exposures are fewer, and far less complete than in the cliffs. So also the collections of fossils have been made mainly on the coast and not from the interior. This is very obvious in our own collections where, if we except the fine series of Malton and Whitwell fossils, only a very imperfect series of the inland Jurassic fauna exists. But these inland beds differ considerably from those described by Phillips at the coast, and it is left for us now to work out much of the detail of the variable groups of jurassic rocks in the interior of the county. Looking at the geological map we see that the mass of the oolites of Yorkshire form an imperfect concentric mass around the vale of Pickering, the rocks dipping down on the north-west and south in a basin shape under that valley. The southern part of this basin or *synclinal* is found near the village of Acklam, and beyond this, from Bishop Wilton to the south of Market Weighton, the oolite rocks are lost to view, being hidden under the overlapping and unconformable rocks of the Cretaceous series.

But to the south of Market Weighton, through Cave and on to the Humber, the oolite rocks have been upheaved and again exposed to the surface, shewing an isolated area of jurassic rocks.

Particular interest attaches to this area as being situated in an intermediate place between the typical Yorkshire and Lincolnshire deposits, and it was therefore a most fortunate circumstance for geologists when, in the construction of the new Hull and Barnsley Railway, it was found necessary to carry the line through the Cave district, cutting through the hills and exposing the rocks in a series of sections only second in importance to those of the coast.

As we pass eastward from the low plain of York we meet with three successive ridges of land with intervening valleys before reaching the chalk wolds. These ridges are formed of the liassic, lower oolite, and middle oolite rocks, and their structure has been fully displayed by the railway excavations. Much of the detail has, however, again become hidden in the levelling and grassing of the slopes. The first, or Everthorpe cutting is mainly in the liassic series, also exhibiting a good section of chalk gravel.

The lias clay here seen is the ordinary blue clay, containing but few fossils; but a species of *Ammonites* (*Ægoceras capricornus*), which was not uncommon, served to determine the exact position of the bed, viz: the *Capricornus* zone of the middle lias. Other beds of the middle lias of an arenaceous character next succeed, there being first a soft red clayey sandstone (three feet thick), with *Avicula inequivalvis*, and then five feet of hard brown flaggy sandstone, more or less calcareous. A number of fossils occurred here, amongst which are *Waldheimia resupinata* and *Rhynchonella terahedra*, characteristic middle-lias species, found especially in the *margaritatus* and *spinatus* zones. Thus we see that the first cutting consists entirely of the *middle* lias formation, the lower division having been planed down by denuding agents to the level of the Vale of York, instead of standing out in hills, as it does further north at the village of North Cliff, etc.

The upper lias also is not seen anywhere in the cuttings, but it doubtless exists in the low ground to the east. Passing over this by the railway embankment (2,508 feet) we enter a second cutting, about twelve feet deep, where a set of pale-coloured oolitic limestones is exposed. It is a well-bedded rock, and the surfaces often shew numerous fragments of shells and branches of the little millipore, known as *Cricopora straminea.* A few other fossils have also occurred, namely— *Trigonia conjungens*, *Lima pectiniformis*, *Hyboclypus*, etc. Altogether this rock and its fossils agree well with the Millepore rock of Yorkshire, especially as it is developed in the neighbourhood of Castle Howard Railway Station. Much of the stone is blue-hearted.

Our next exposure is the fine Drewton section, shewing a magnificent development of the Kelloway rock and part of the Oxford clay ; also drift and gravel capping the hill.

The Kelloway series forms the greater part of this section, its total thickness amounting to thirty-five feet, and extending from one end of the cutting to the other, lying at an angle of five degrees. The series is conspicuously divided into two divisions—the rock bed above and the sands below ; and the latter may be again divided into the (1) lower sands, pure and white, highly micaceous, and, notwithstanding its incoherence, well jointed, in which no fossils were found (five feet), and (2) the remaining twenty feet consisting of ordinary pale yellow sands, with iron-stained patches. Two small irony bands, somewhat more hardened, and crowded with casts of belemnites, occur in the lower part of this series, and in the upper portion, which is more deeply iron-stained, there is a double line of large boulder-like masses or concretions, of a hard and siliceous nature. Shells of *Myacites* and *Belemnites* occur in them. A number of these nodules are still seen standing out prominently on the sides of the cutting.

The next succeeding bed is the most conspicuous rock in the cutting, forming a bold rocky ridge along the whole section.

This is the rock bed of the Kelloway series—a moderately hard, jointed ferruginous sandstone of red or brownish yellow colour, eight feet ten inches thick. Fossils abound in it, especially the gryphite shell, *Gryphea bilobata*, large groups of which were readily obtained. Some fifty species were found, including many characteristic Kelloway shells.

LIST OF FOSSILS FROM THE KELLOWAY ROCK, OF DREWTON, NEAR SOUTH CAVE.

Rhynchonella socialis, *Phil.*
Waldheimia ornithocephala, *Sby.*
Gresslya peregrina, *Phil.*
Pholadomya ovulum, *L. & M.*
Goniomya literata, *Sby.*
Myacites decurtatus, *Ph.*
Myacites.
Astarte lurida, *Phil.*
,, sp.
Isocardia.
Corbicella ovalis, *Phil.*
Cyprina.
Cardium.
Cardium Crawfordii, *Leck.*
Unicardium depressum, *Ph.*
Cucullæa corallina, *Damon.*
Cucullæa, sp.
Arca, sp.
Modiola pulchra, *Phil.*
Trigonia Rupellensis, *d'Orb.*
Perna quadrata, *Phill* (*non Sby.*)
Perna rugosa, *Goldf.*
Pinna mitis, *Phil.*
Pecten demissus, *Phil.*
Pecten, sp.
Avicula inæquivalvis, *Sby.*
Placunopsis.
Avicula Braamburiensis, *Phil.*
Gryphæa bilobata, *Sby.*
Turbo, sp.
Alaria bispinosa, *Phil.*
Cerithium Culleni, *Leck.*
Turbo sulcostomus, *Phil.*
Ammonites calloviensis, *Sby.*
Am. Jason, *Rein.*
Am. Mariæ, *d'Orb.*
Am. modiolaris, *Shuid.*
Am. Gowerianus, *Sby.*
Am. Kœnigi, *Sby.*
Am. sublævis, *Sby.*
Belemnites Oweni, *Pratt.*

The dark blue homogneous clay above this rock is the Oxford clay in its proper position, containing the common fossils *Belemnites Owenii*, *B. abbreviatus*, *Gryphea dilatata*, and *Plesiosaurus.* The rest of this cutting consists of the drifts and gravels, namely—a stiff blue boulder clay, fine yellow sands, and a coarse chalk gravel.

Much of the Oxford clay is, no doubt, hidden in the next valley, together with some Kimmeridge clay; but there is no sign of the presence of the Corallian rocks.

We now reach the chalk wolds, where an interesting series of beds has been exposed in cuttings and tunnels. Some confusion has been produced here by the slipping of the chalk over the Kimmeridge and Red chalk clays, which affects the level and apparent thickness of the latter rock. The Kimmeridge clay is seen in several places: it is uniformly a black shaley clay, in which flattened *Ammonites* were found, but the species could not be determined. There can be little doubt as to its age.

The Red chalk is also well exposed, and one section (now hidden) gave a thickness of six feet eight inches. The true thickness may exceed this. The rock, especially in the upper four feet, is of a hard, rubbly or nodular character, a red clay occurring at the base. The fossils found were the common *Belemnites minimus* and *Terebratula semiglobosa.*

There is little that calls for special notice in the grey chalk and lower chalk. Seams of fullers earth are found in them, separating the beds, and the joint surfaces of the chalk are frequently coated with a black deposit of manganese.

There are two special beds now to be noticed in the white chalk. A zone of pink chalk, some thirty feet from the top of the red chalk, in thickness about 1 foot; and at twenty-five feet higher, there is a remarkable bed of an argillaceous and carbonaceous character, the central part being black and coaly, and yielding fragments of plants. The upper and lower divisions of this zone are laminated and jointed marls of pale yellow, greenish and brown colour, much of it being fullers earth. It is devoid of fossils. The total thickness of this series is about three feet.

Having now finished the description of the sections, there remains the question of the relations of these rocks to the neighbouring type in North Yorkshire and Lincolnshire.

Of late many geologists seem disposed to refer the South Yorkshire jurassic to the Lincolnshire type. This is supported by the absence of the great Yorkshire sandstones; but, on the other hand, the best marked rocks—the Millepore and Kelloway groups—agree well with the Yorkshire types, both in rocks and fossils. Nor do I see the necessity of referring them exactly to either type. They occupy an intermediate position, and may well be intermediate in character, for there is no doubt they were all formed as one continuous deposit.

In the sections here exposed I have not found a greater affinity to the Lincolnshire than to the Yorkshire type of jurassic rocks.